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EXAMINER

ANDUJAR, LEONARDO

ART UNIT PAPER NUMBER

2826

DATE MAILED: 09/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/827,014

Applicant(s)

ADAE-AMOAKOH ET AL. *en*

Examiner

Leonardo Andújar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 20-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 20-24 and 26-29 is/are rejected.
- 7) ☒ Claim(s) 25 and 30 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Acknowledgment

1. The amendment filed on 06/10/2003 was entered and treated as a response to a non-final rejection. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 1-9 and 20-30.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-6, 9, 20-24 and 26-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Takubo et al. (US 6,329,610)

4. Regarding claim 1, Takubo (e.g. fig. 3) shows an electronic structure comprising:

- A substrate having a dielectric layer 22 between a first metal layer 14a and a second metal layer 13a having a top surface that includes a selected area (the area around the through hole);

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- A contact area located in the first metal layer (the region in contact with the layer 33);
- A microvia cavity located within the selected area and extending through the second metal layer and the dielectric layer;
- And a mass of single conductive material 33 forming a layer upon the selected area of the top surface of the second metal layer and totally filling the microvia cavity and being in contact with the first contact area of the first metal layer.

5. As shown in figure 3, the selected area is disposed above the first contact area.

6. Regarding claim 2, Takubo shows that the mass of the single conductive material conformally fills the microvia cavity.

7. Regarding claim 3, Takubo shows that the mass of the single conductive material has a planar surface forming a contact pad. The contact pad is located parallel to the first metal layer. Also, the contact pad is located opposite to the first contact area of the first metal layer.

8. Regarding claim 4, Takubo shows that the selected area is approximately centered around the microvia cavity.

9. Regarding claims 5 and 6, Takubo shows that the second metal layer within the selected area is approximately centered around the microvia cavity.

10. Regarding claim 9, Takubo discloses that the mass of the single material comprises a conductive paste (col. 16/lis. 29-30).

11. Regarding claim 20, Takubo (e.g. fig. 2) shows an assembly:

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- A semiconductor chip 41 having a circuit;
- A substrate having a dielectric layer 22 between a first metal layer 14a and a second metal layer 13a having a top surface that includes a selected area (the area around the through hole);
- A first contact area located in the first metal layer (the region in contact with the layer 33);
- A microvia cavity located within the selected area and extending through the second metal layer and the dielectric layer;
- And a mass of a single conductive material 33 forming a layer upon the selected area of the top surface of the second metal layer and totally filling the microvia cavity and being in contact with the first contact area of the first metal layer.

12. The second metal layer is located above the first metal layer and the selected area is disposed above the first contact area. Also, the semiconductor chip is electrically connected to the mass of the conductive material.

13. Regarding claim 21, Takubo shows that the selected area is a planar area.

14. Regarding claim 22, Takubo shows that the selected area is a planar area that is about parallel to a planar top surface of the first metal layer.

15. Regarding claim 23, Tabuko shows that the single conductive material is made of conductive paste and the second metal layer is made of copper (col. 15/lls. 50-51 & col. 16/lls. 27-31). Note that the etch rate of the conductive paste is lower than the etch rate than copper (inherent).

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16. Regarding claim 24, Tabuko shows that the single conductive material is bonded to the wall of the microvia cavity (e.g. fig. 3).

17. Regarding claim 26, Takubo shows that the selected area is a planar area.

18. Regarding claim 27, Takubo shows that the selected area is a planar area that is about parallel to a top surface of the first metal layer.

19. Regarding claim 28, Tabuko shows that the single conductive material is made of conductive paste and the second metal layer is made of copper (col. 15/lis. 50-51 & col. 16/lis. 27-31). Note that the etch rate of the conductive paste is lower than the etch rate than copper (inherent).

20. Regarding claim 29, Tabuko shows that the single conductive material is bonded to the wall of the microvia cavity (e.g. fig. 3).

Claim Rejections - 35 USC § 103

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

22. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a

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later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

23. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takubo et al. (US 6,329,610) in view of Sasaoka et al. (US 6,010,769).

24. Regarding claim 7, Takubo teaches that the second metal layer contains a flat copper land around the microvia (e.g. fig. 3; col. 15/lis. 50-51). Although it is well known in the art the benefits of using a ring shaped Takubo does not explicitly disclose it. However, this limitation is considered an obvious design choice. Design choice limitations are not patentable unless unobvious or unexpected results are obtained from these changes. It appears that these changes produce no functional differences and therefore would have been obvious. Note *In re Leshin*, 125 USPQ 416. For example, Sasaoka discloses that via lands having a ring shape can release the normal line stress acting on a conductive pillar in its axial direction. Thereby, the breakage of via connection is prevented (e.g. fig. 2; col. 27, 28 and 37). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the flat copper land disclosed by Takubo having a ring shape in order to prevent the breakage of via connection as suggested by Sasaoka.

25. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takubo et al. (US 6,329,610) in view of Kawasaki (US 5,372,666).

26. Regarding claim 8, Takubo disclose that it is known in the art that vias can be made having truncated cone shape (e.g. figs. 10 and 12). In any case, the

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hole shape, absent any criticality, is only considered to be an obvious modification of the shape of the via hole disclosed by Prior Art as the courts have held that a change in shape or configuration, without any criticality, is within the level of skill in the art as the particular shape claimed by applicant is nothing more than one of numerous shapes that a person having ordinary skill in the art will find obvious to provide using routine experimentation based on its suitability for the intended use of the invention. See *In re Dailey*, 149 USPQ 47 (CCPA 1976). For example, Kawasaki discloses that vias having truncated cone shape can be filled with a conductive material without trapping air, thereby forming a via which has a good conductivity (col. 3/lls. 41-47). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the via disclosed by Takubo having a truncated cone shape in order to form a via having a good conductivity since vias having this shape can be filled with conductive material without trapping air as taught by Kawasaki.

Response to Arguments

27. Applicant's arguments filed 06/10/2003 have been fully considered but they are not persuasive.

28. Applicant argues that Takubo does not teach "*a mass of a single conductive material forming a layer upon the selected area of the second metal layer, because the conductive material is not a layer that satisfies the requirement of claims 1 and 20*". A layer is defined as "a thickness of some material laid on or spread over a surface (definition provided by applicant, paper no.6, pg. 8). According to applicant the conductive plug 33 disclosed by Takubo

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in figure 3 "*has not thickness, because the conductive plug lacks of physical boundary from which a thickness could be ascertained, as measured from the first surface of the conductive plug*". Nonetheless, Takubo clearly shows that mass of conductive material 33 has a thickness and is laid on or spread over a surface 14a. In this case, the thickness is defined by top and bottom surfaces of the conductive material 33 (see fig. 3).

Allowable Subject Matter

29. Claims 25 and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

30. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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31. Papers related to this application may be submitted directly to Art Unit 2826 by facsimile transmission. Papers should be faxed to Art Unit 2826 via the Art Unit 2826 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2826 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2826 Fax Center is to be used only for papers related to Art Unit 2826 applications. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Leonardo Andújar** at **(703) 308-0080** and between the hours of 9:00 AM to 6:00 PM (Eastern Standard Time) Monday through Friday (with alternated Fridays off) or by e-mail via Leonardo.Andujar@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn, can be reached on (703) 308-6601.

32. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 305-3900**.

33. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass (es): 257/691,778; 174/256, 266	08/03
Other Documentation:	
Electronic Database(s): East (USPAT, US PG PUB, JPO, EPO, Derwent, IBM, JPL, etc.) NATHAN J. FLYNN SUPERVISORY PATENT EXAMINER GROUP 2800	08/03

Leonardo Andújar

Patent Examiner Art Unit 2826

LA
8/22/03